

Why Consider Mussels?

**Is Stream Health Reflected in Native
Mussel Communities?**



Are mussels - sentinels of riverine health?



Six Reasons to Consider Mussels



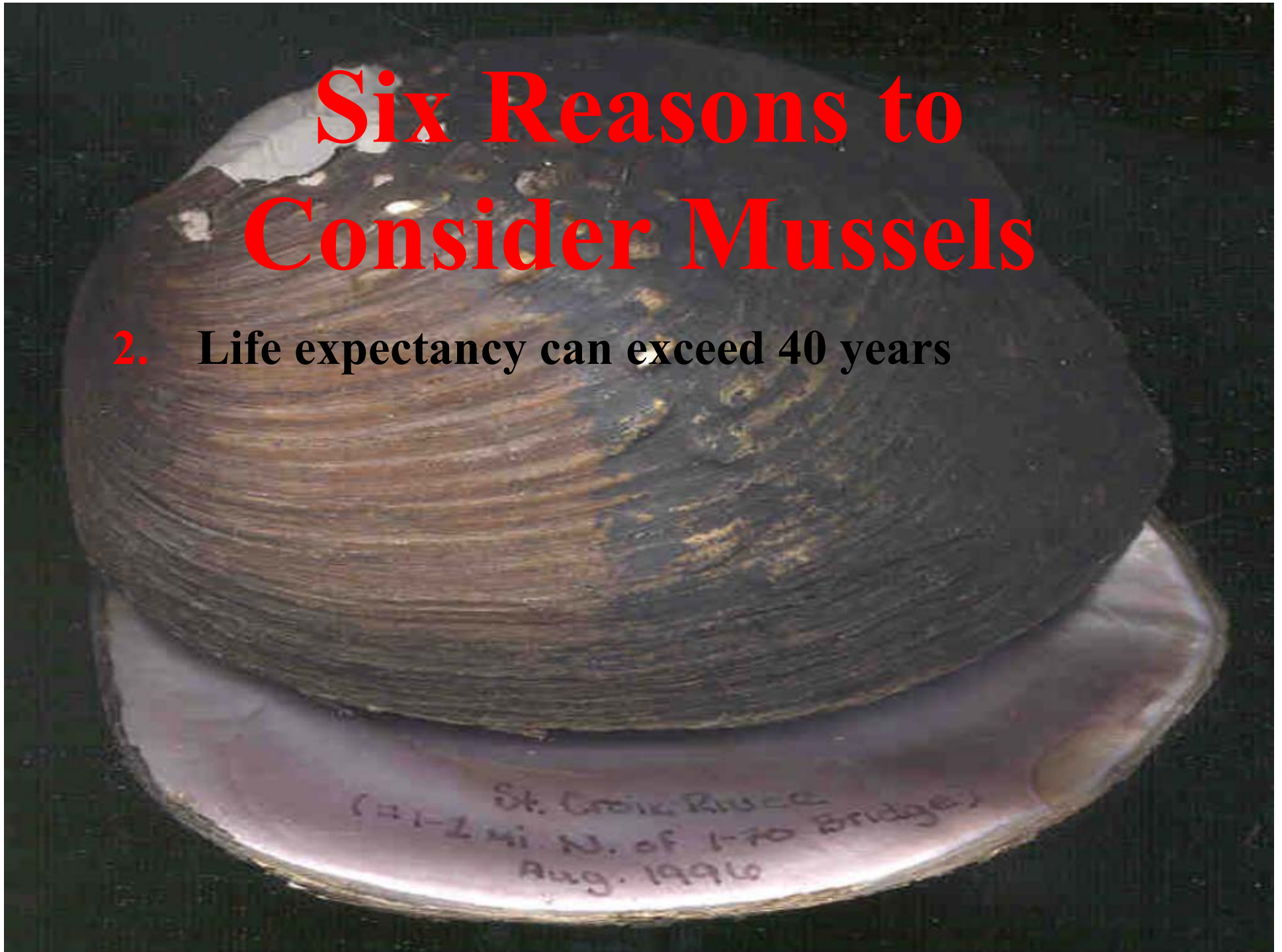
Six Reasons to Consider Mussels

An underwater photograph showing a rocky seabed covered with numerous mussels. The mussels are of various sizes and colors, including shades of brown, grey, and white. Some mussels are open, showing their gills. The background is a dark, textured rock surface.

- 1. Sessile, obligate consumers of FPOM**

Six Reasons to Consider Mussels

2. Life expectancy can exceed 40 years



Six Reasons to Consider Mussels

3. in situ shell record of past existence

Collections of old shells during sampling can reveal composition of past mussel community as well as the present community



Top of
midden

**Prehistoric shell middens can
reveal the community of species
present – a reference condition**

Six Reasons to Consider Mussels



Each annulus
incorporates materials
Ingested during that
years growth

4. A record of contaminant levels passing through the stream may accumulate in shell

Six Reasons to Consider Mussels

5. Aggregations of mussels create physical habitats in rivers. Gardens of algae and invertebrates live attached to their shells and among the spaces between them

Mussel Bed – Sunrise River, MN



Six Reasons to Consider Mussels



**6. Fish are attracted to mussel beds
and serve as hosts to their larvae**

Mussel bed at foot of Lake Pepin, Mississippi River

Steps to Assessing the Mussel Community of a Stream

- Historic Records
- Basic Surveys
- Selecting Monitoring Sites
- Establish Parameters to Measure
- Collect Data
- Repeat

Steps to Assessing the Mussel
Community of a Stream

Historic Records

- Museum collections
- Literature search
- Agency Files – surveys required for permits

Steps to Assessing the Mussel Community of a Stream

Basic Surveys

- **Reconnaissance** - access points, habitat types
- **Qualitative Surveys** - timed searches, wading, snorkeling, SCUBA – good for rapid assessments
- **Quantitative Surveys** – quadrats, total substrate samples, transects, combinations

Steps to Assessing the Mussel
Community of a Stream

Basic Surveys

Qualitative Surveys

Timed search results

- Catch Per Unit Effort (CPUE) - number of mussels collected/minute
- Species list
- Relative abundance of each species in community
- Size/Age range for each species
- Personnel bias can be a problem
- Allows for rapid assessment of many sites







River: Miss Pool 7 Site: _____ Methods (no. pers.) Wade Snorkel 3 SCUBA Date: 10/3/01 Page 1 of 2 Site Id # _____
Way Point# 247

Site comment: Winners Landing County: _____ Range: _____ Substrates: ☒ Silt ☒ Cobble ☐ Residential ☐ Veg/Grass
River Mile: 708.7 Township: _____ ☒ Sand ☒ Boulder ☐ Forest Other: _____
Desc. Bank: _____ Section: _____ ☐ Gravel ☐ Bedrock ☐ Ag/Crops
L M R Other: _____ ☐ Ag/Pasture

Stream Conditions: Depth (ft) min 3 max 14
Width (ft) min _____ max _____
☐ Riffle ☐ Run ☐ Pool

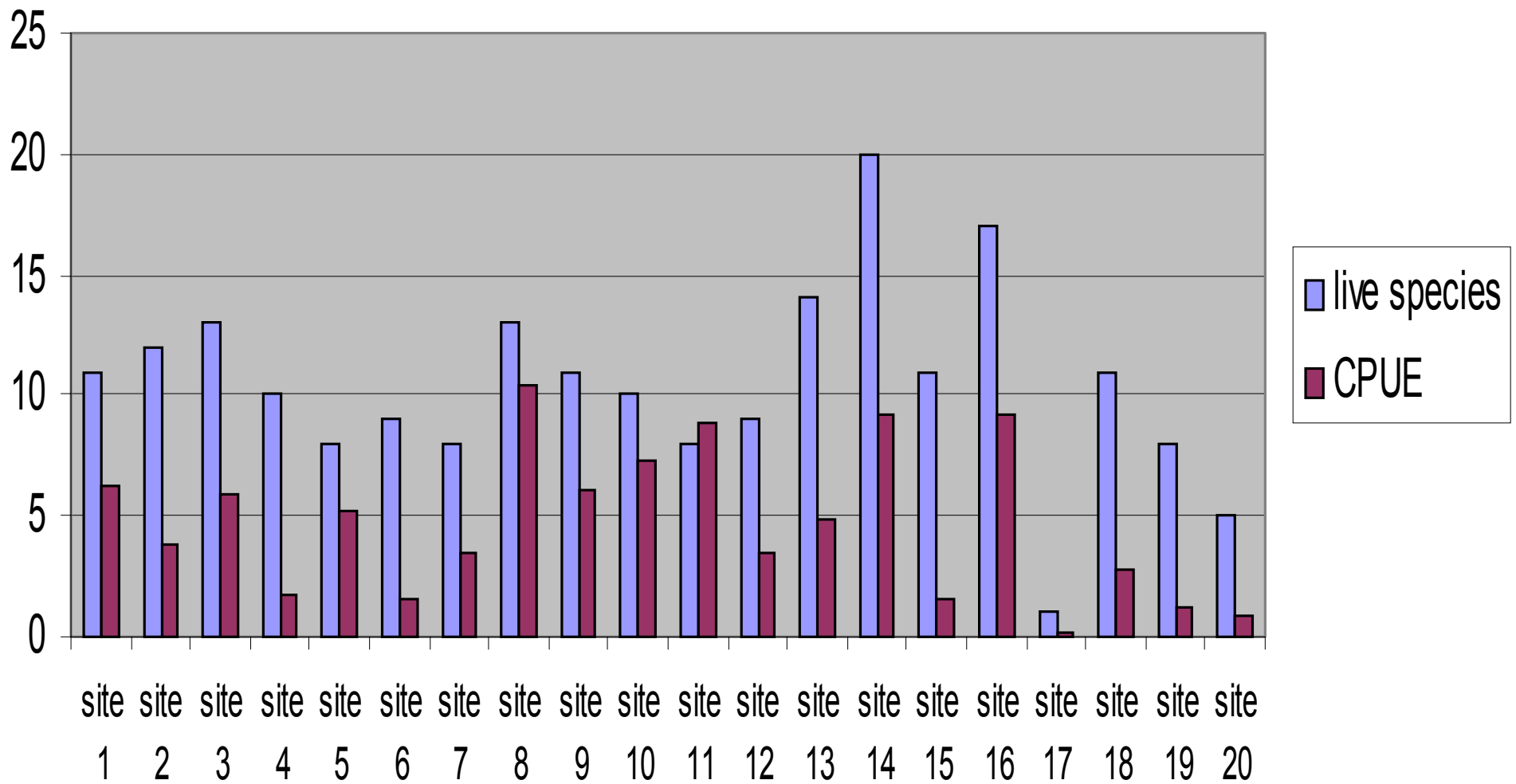
Crew: Kelnd, Davis, Taylor Number of Divers: 3 Total Time Searched (min.) = (#divers x time in min.) 60
UTM: 15 620502 E 4866216 N Number Live in each Age Category: _____ Minimum and Maximum Length in each Age Category: _____
Age <1 - 5 Age 6 - 10 Age >10 Total Voucher/Comments: 10 catch/min

Live Species	Age <1 - 5	Age 6 - 10	Age >10	Total	Min	Max	Min	Max	Min	Max	Min	Max	number/wet/dry	Comments (gravid, eroded, etc.)
<i>A. plicata</i>	22	126	138	346	18	47	40	76	67	115				Many Zebra
<i>L. higginsii</i>		1F	1M 1F	3			71		86	101				by Sals
<i>E. lineolata</i>	4	2	6	12	54	60	55	60	82	96				10% water
<i>L. recta</i>		7	4	11			112	129	145	155				Young Zebra
<i>O. reflexa</i>	8	27	6	41	21	34	40	50	55	60				
<i>L. cardium</i>	7	12	22	41	25	96	88	110	104	120				
<i>O. pustulosa</i>	2	6	22	30	26	36	40	53	53	95				
<i>F. flava</i>		36	34	70			34	59	62	80				
<i>L. siliguoidea</i>	1			1	73									
<i>P. coccinnum</i>	3	13	9	25	24	32	35	62	68	77				
<i>Q. quad</i>	1	1		2	25		63							
<i>P. elatis</i>	1			1	82									
<i>T. don</i>	1			1	20									
<i>T. trunc</i>	2	3		5	23		29	37						

Dead Species	Condition	Vouchered	Dead Species	Condition	Vouchered	Dead Species	Condition	Vouchered

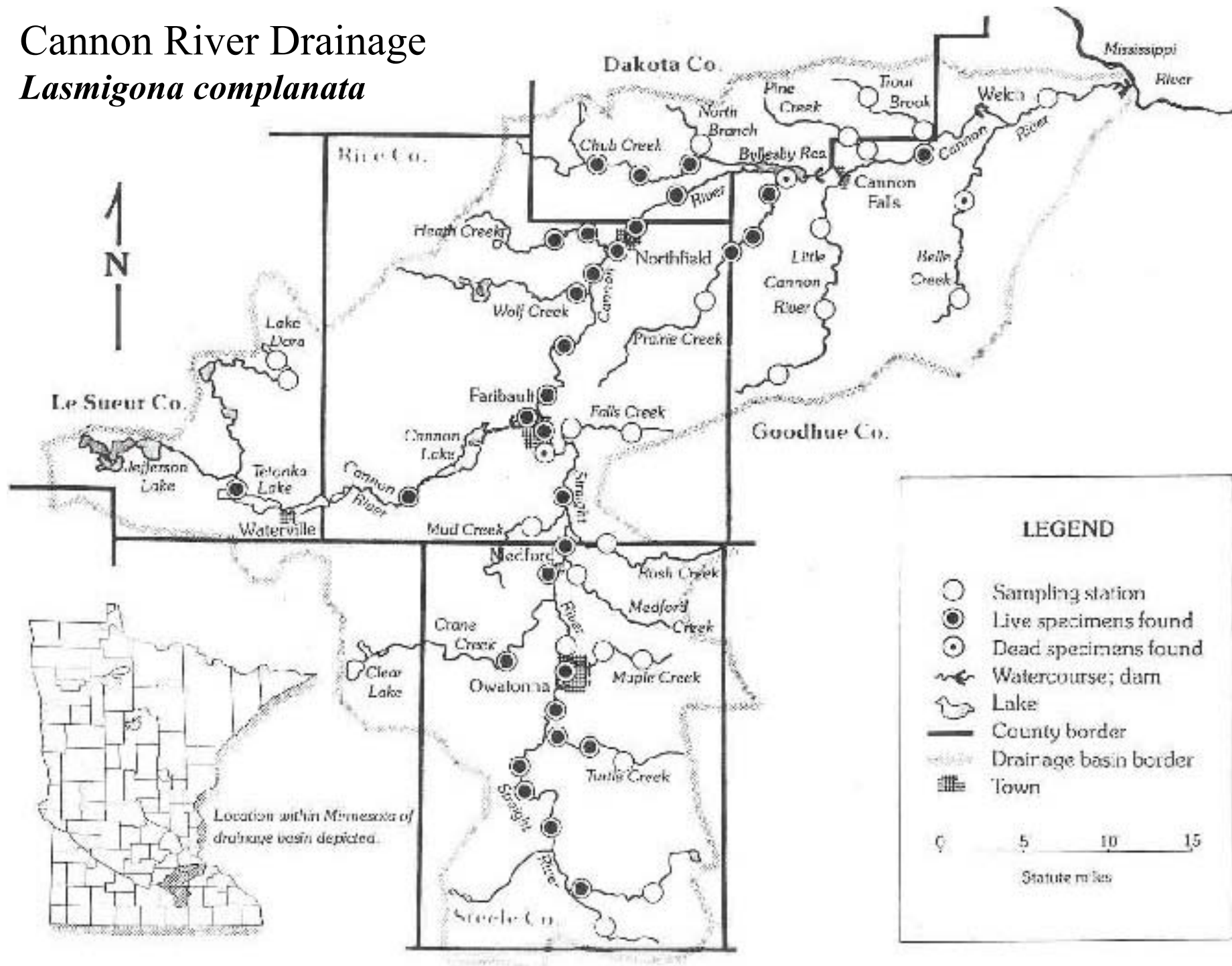
Condition: FD = fresh dead, WD = weathered dead, SF = subfossil

Comparison of Number of live species and CPUE at Qualitative Sites in Pool 7 Fall 2001



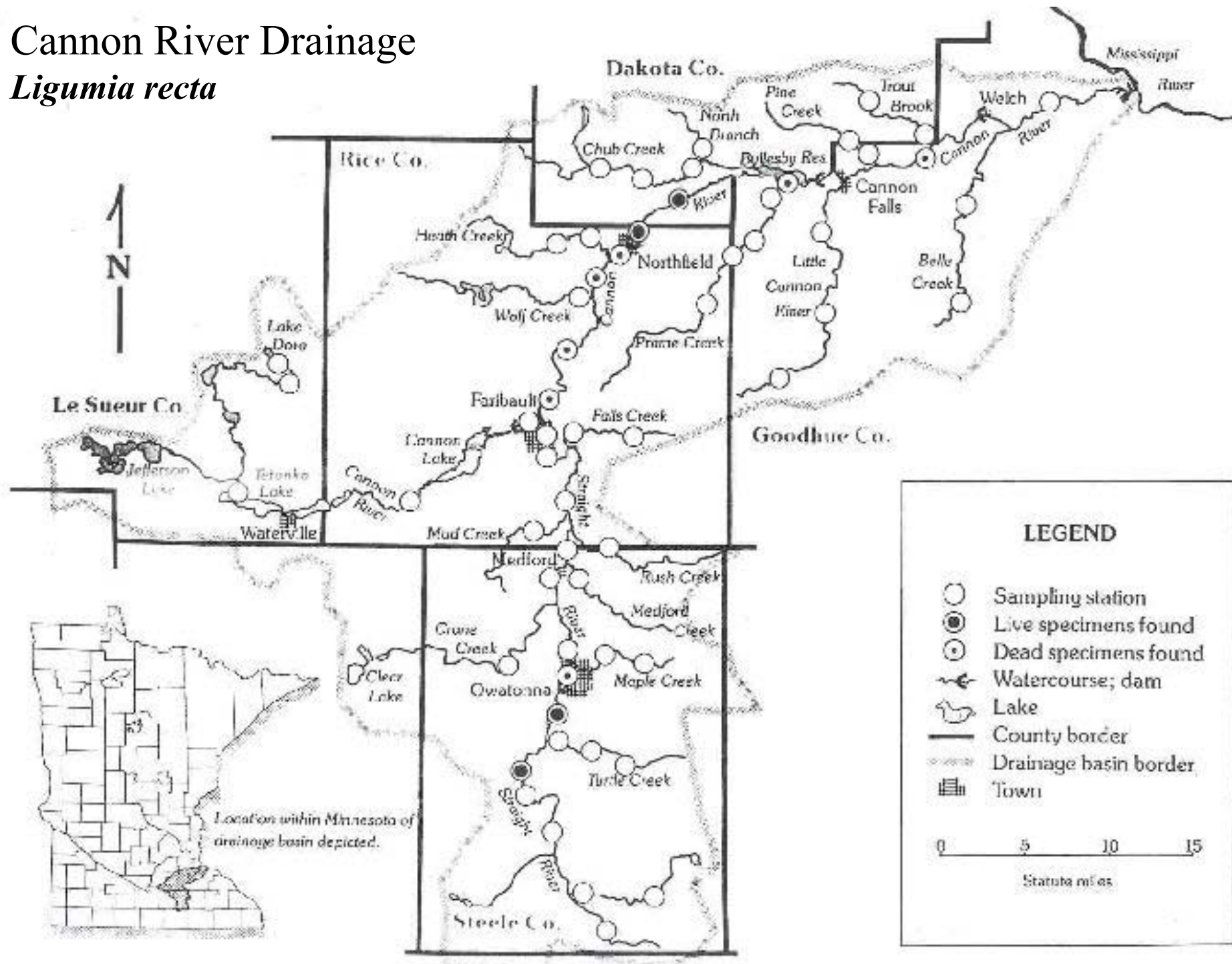
Cannon River Drainage

Lasmigona complanata



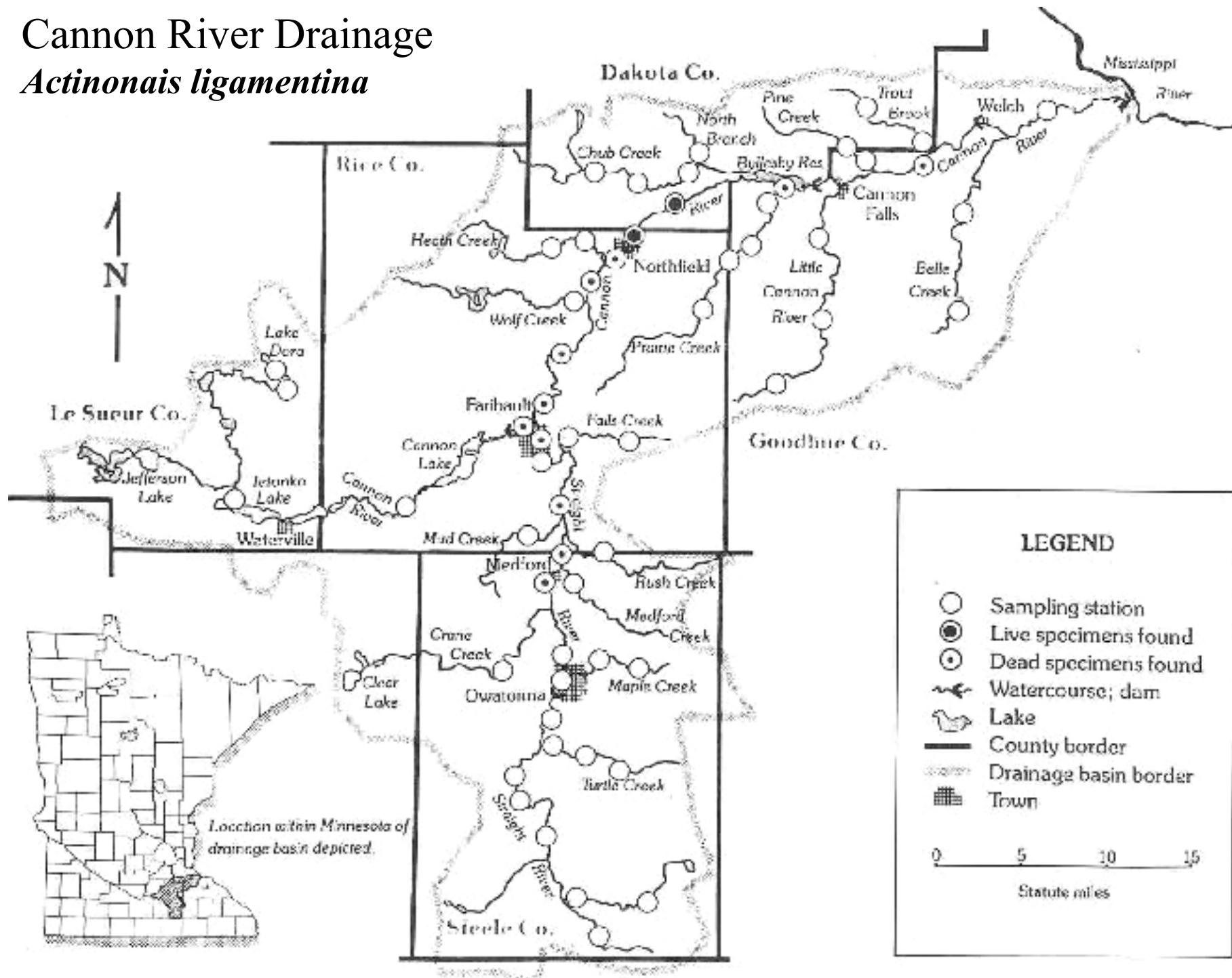
Cannon River Drainage

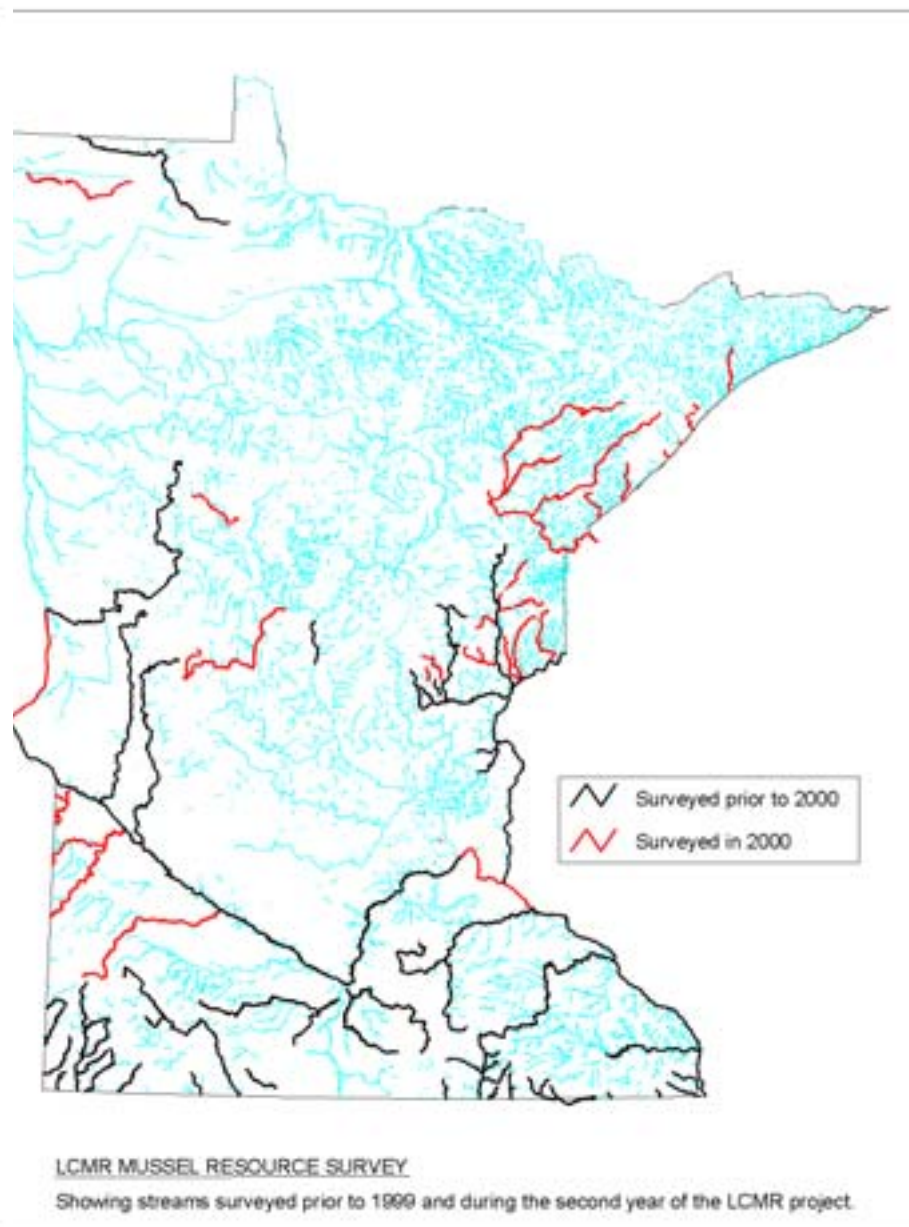
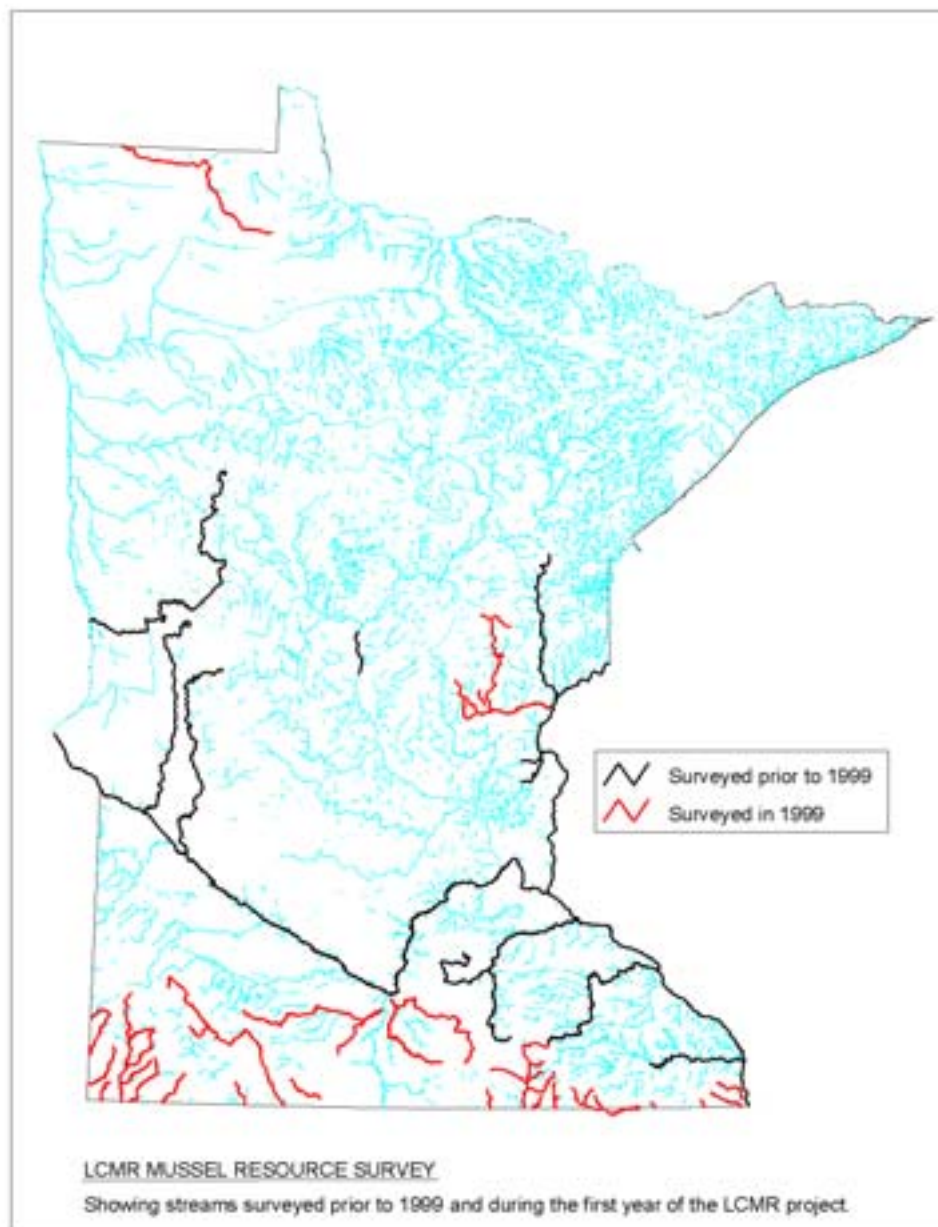
Ligumia recta

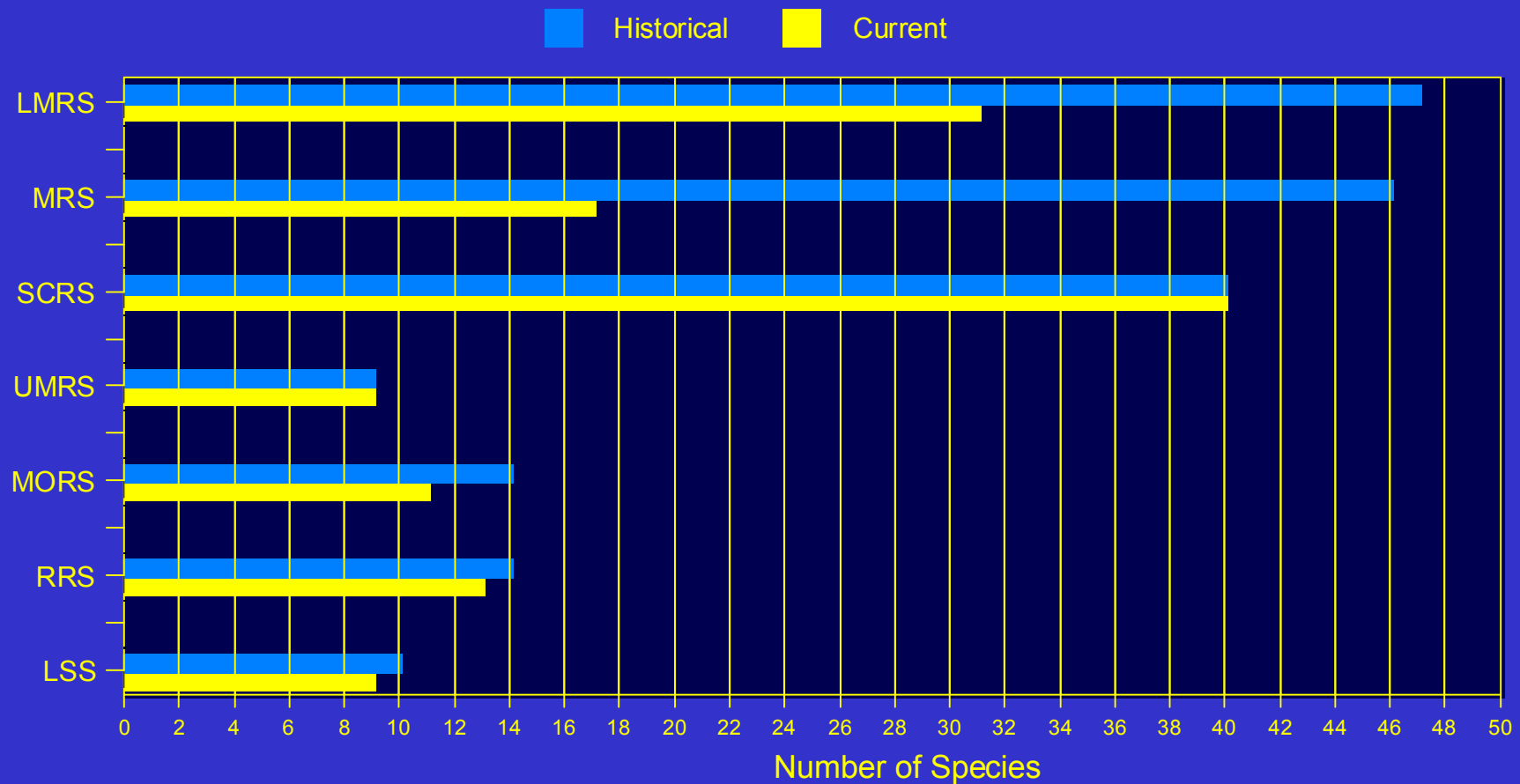


Cannon River Drainage

Actinonais ligamentina



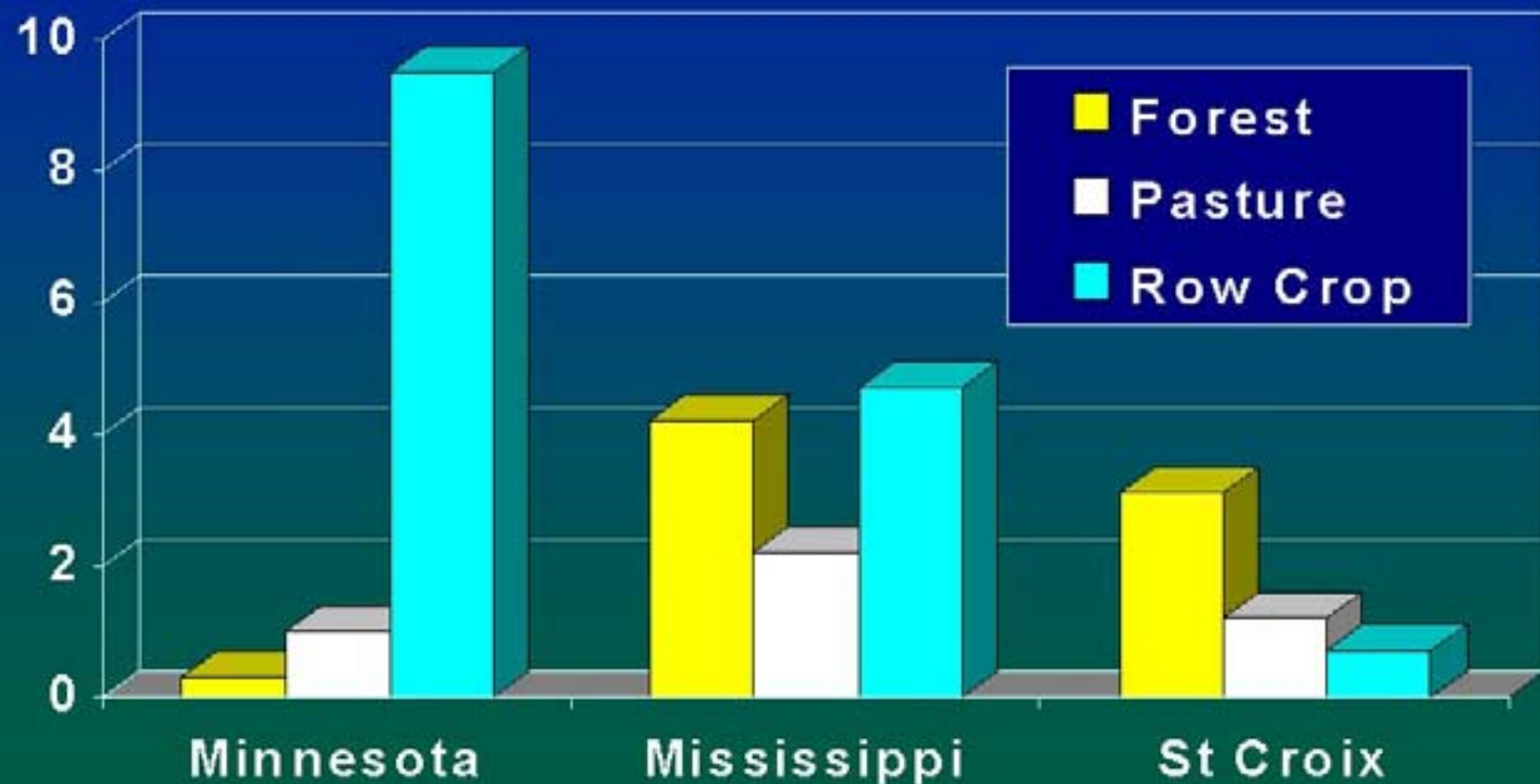




LMRS=Lower Mississippi River Drainage (below St. Anthony falls), MRS=Minnesota River Drainage, SCRS=St. Croix River Drainage UMRS=Upper Miss R. above St. Anthony Falls, MORS=Missouri River Drainage, RSS=Red River Drainage, LSS=Lake Superior Drainage.

A comparison of historical vs. current mussel species richness in Minnesota's drainages.

1992 Land Use by River Basin (million acres)



Steps to Assessing the Mussel
Community of a Stream

Basic Surveys

Quantitative Surveys

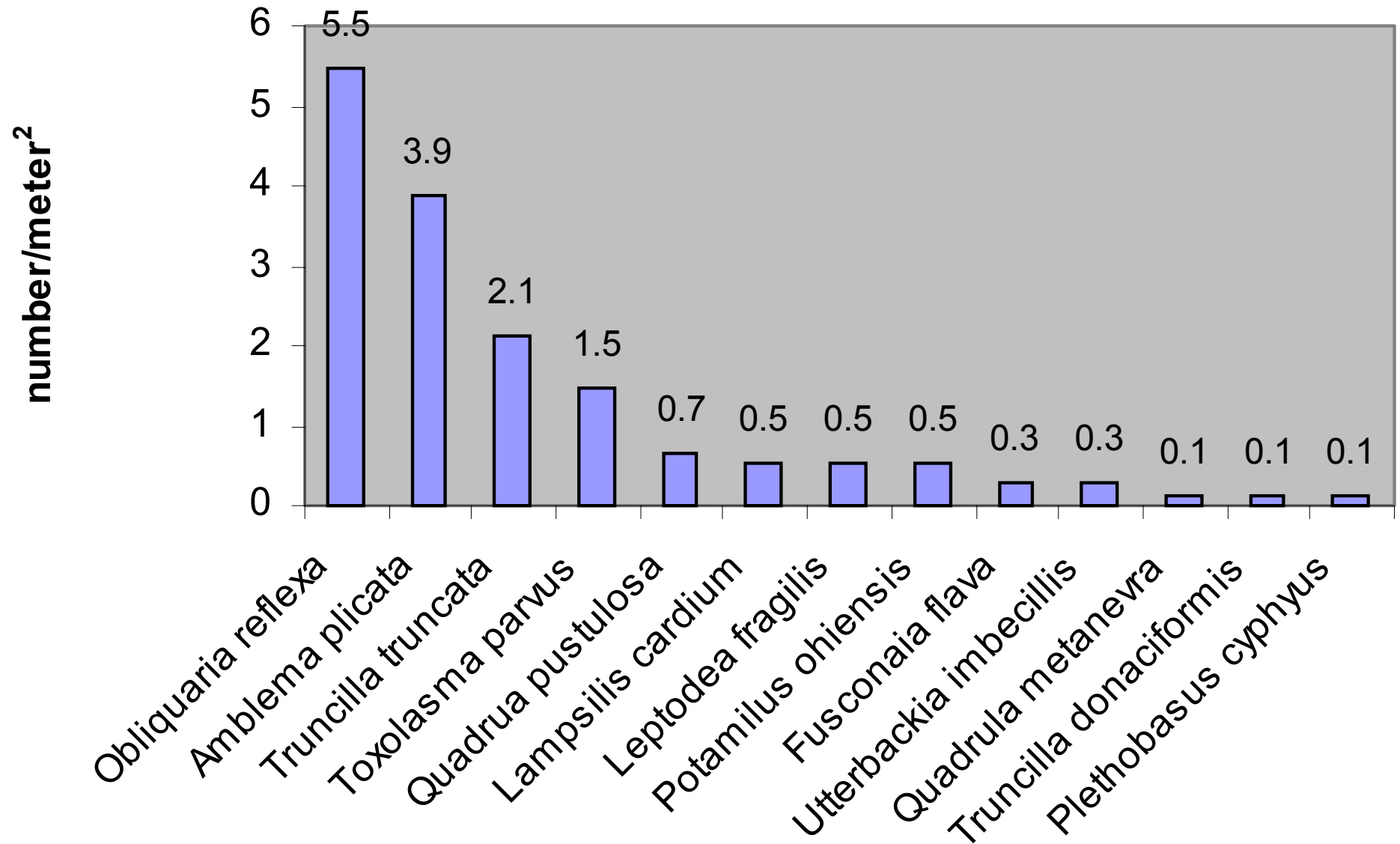
quadrat samples

- Mussel density/unit area
- Species abundance/unit area
- Size and age demographics for all size classes
- Personnel bias reduced to near zero
- Random placement of quadrats allows for statistical analysis
- Extremely time consuming

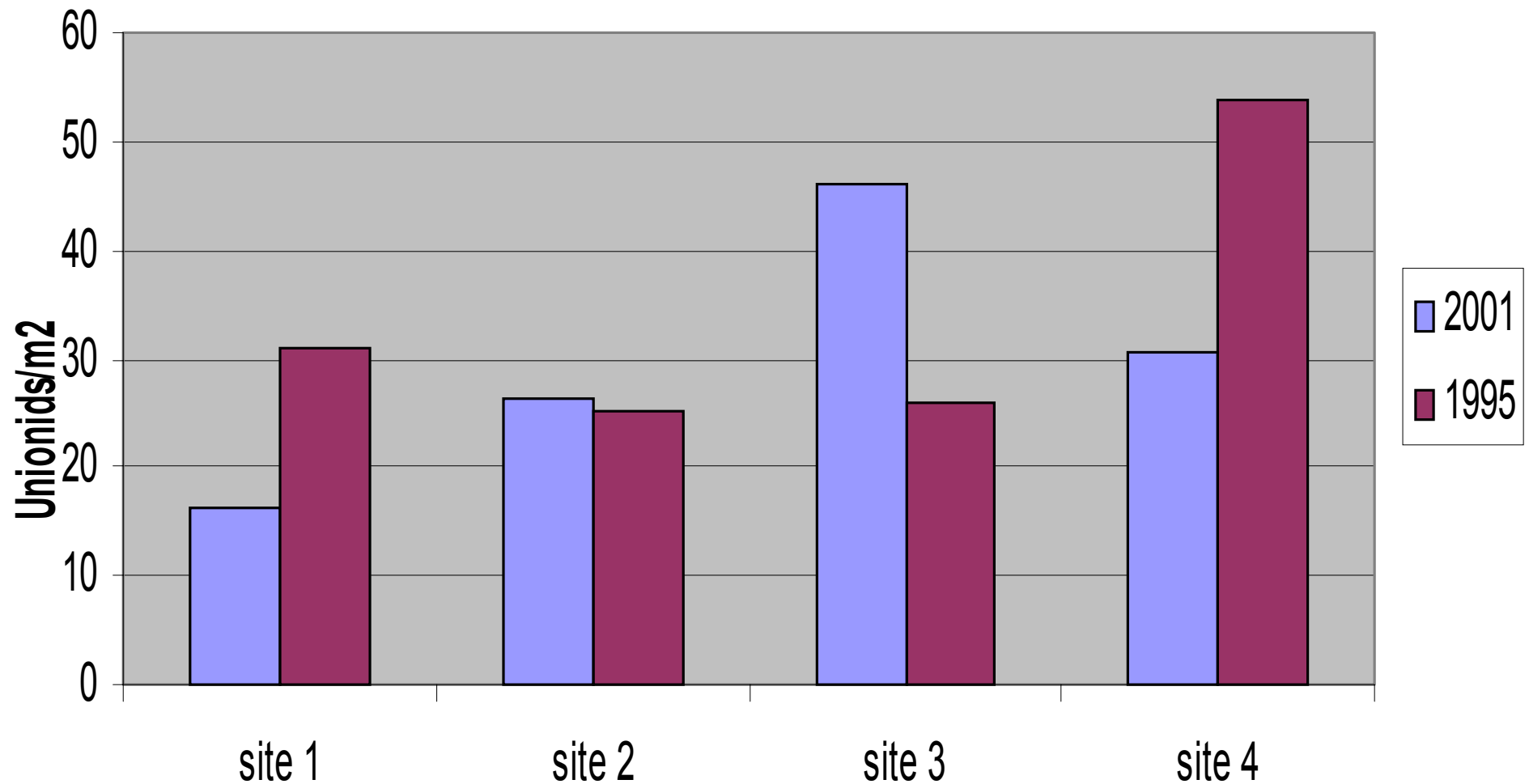




Richmond Island Site 1, 9/24/01
species density (total = 16.1)

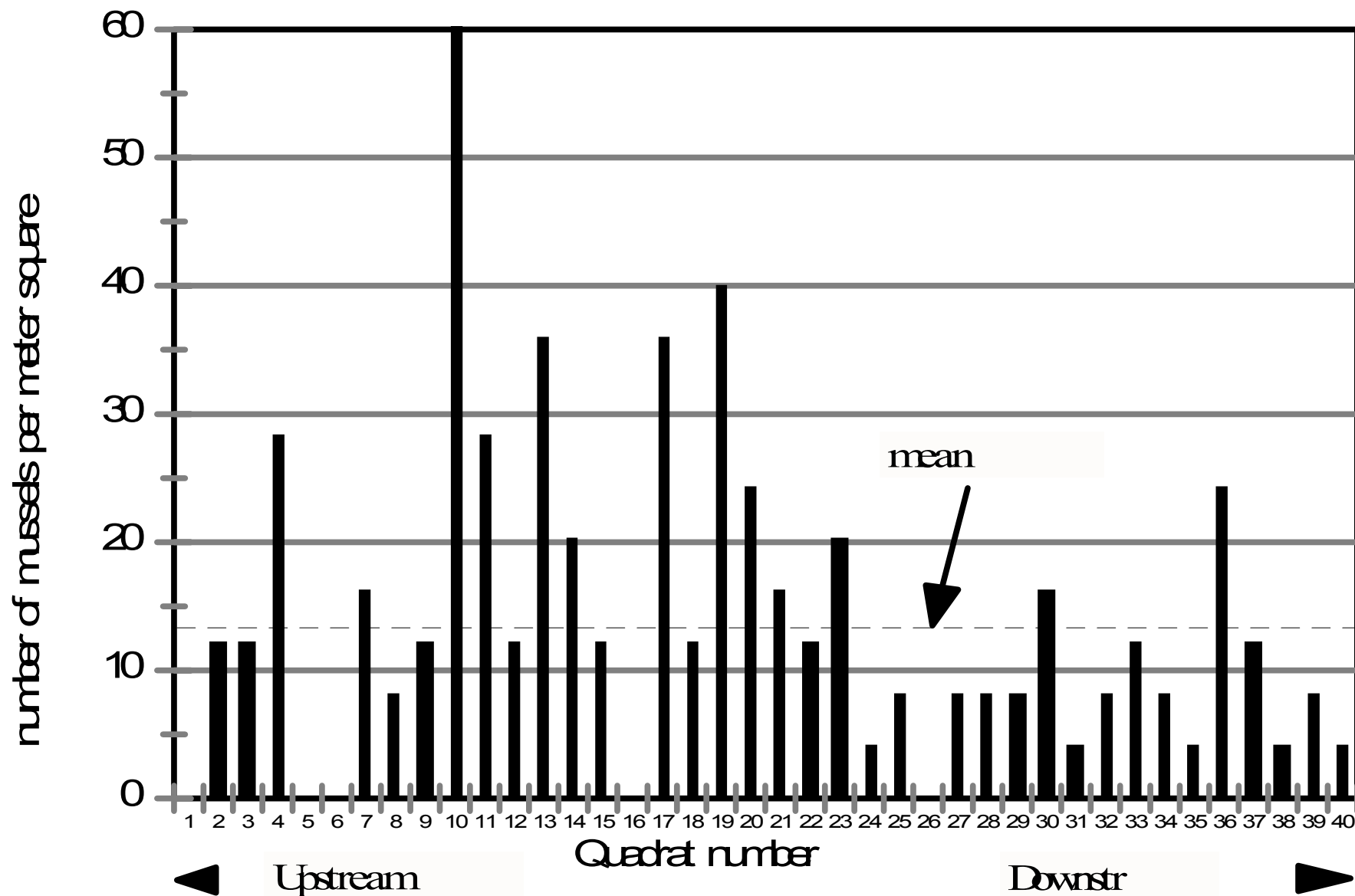


Unionid Mussel Density at Quantitative Sites Near Richmond Island in 1995 and 2001



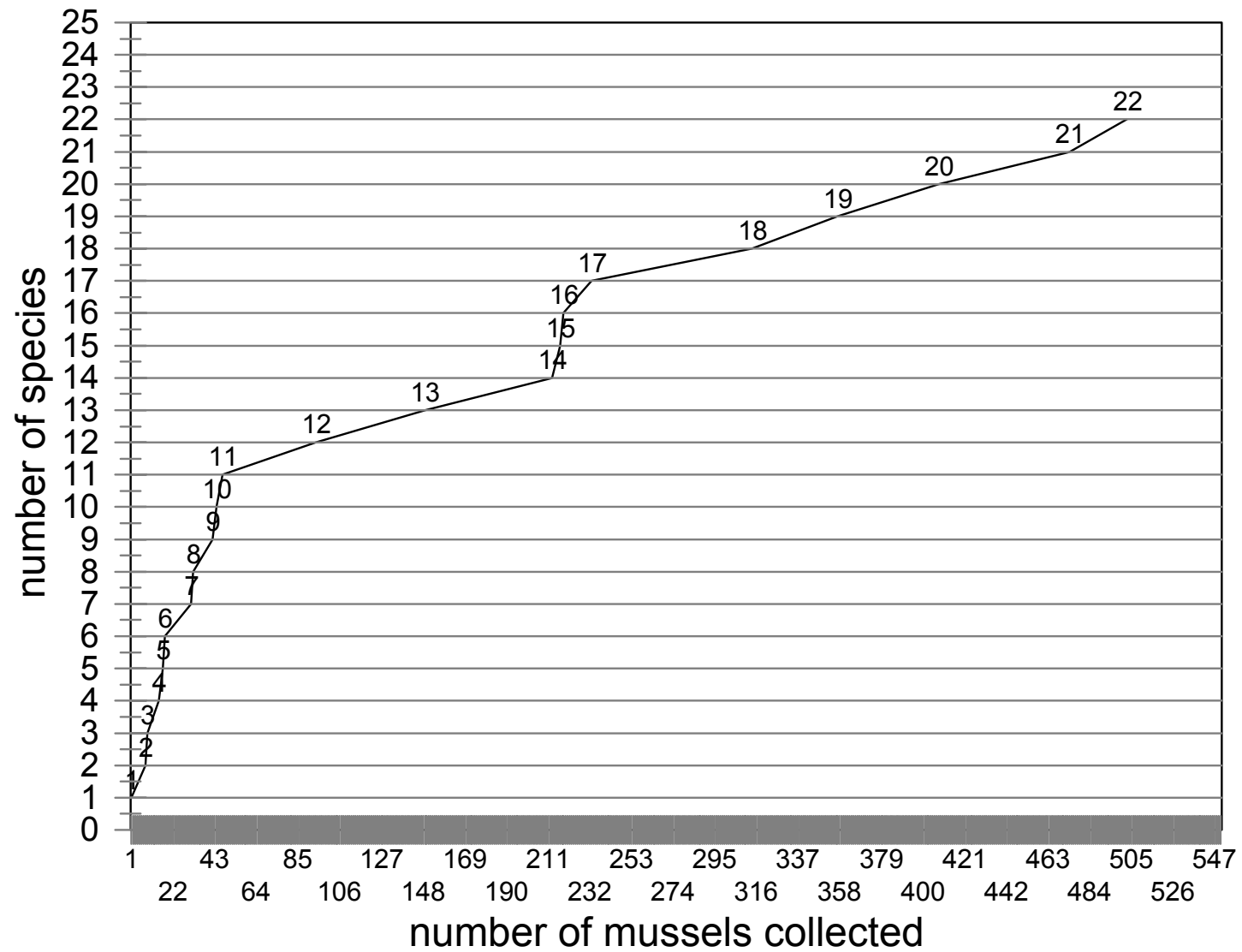
ARTCO FLEETING 8/21-23/2000

Density of mussels by quadrat sample



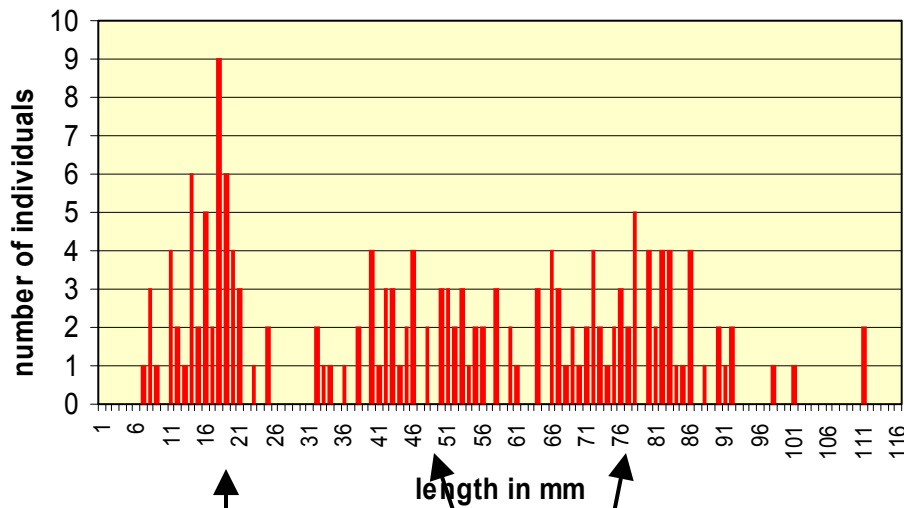
ARTCO FLEETING MUSSEL SURVEY

cumulative species plot



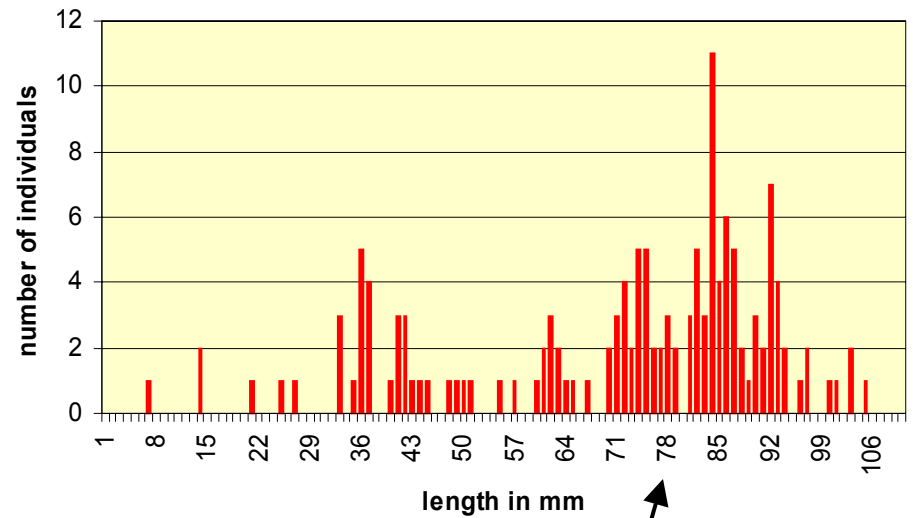


Richmond Island Site 3, 9/26/01
Amblema plicata length frequency



Length frequency analysis shows recent and recurrent recruitment at this site

Richmond Island Site 4, 9/25/01
Amblema plicata length frequency

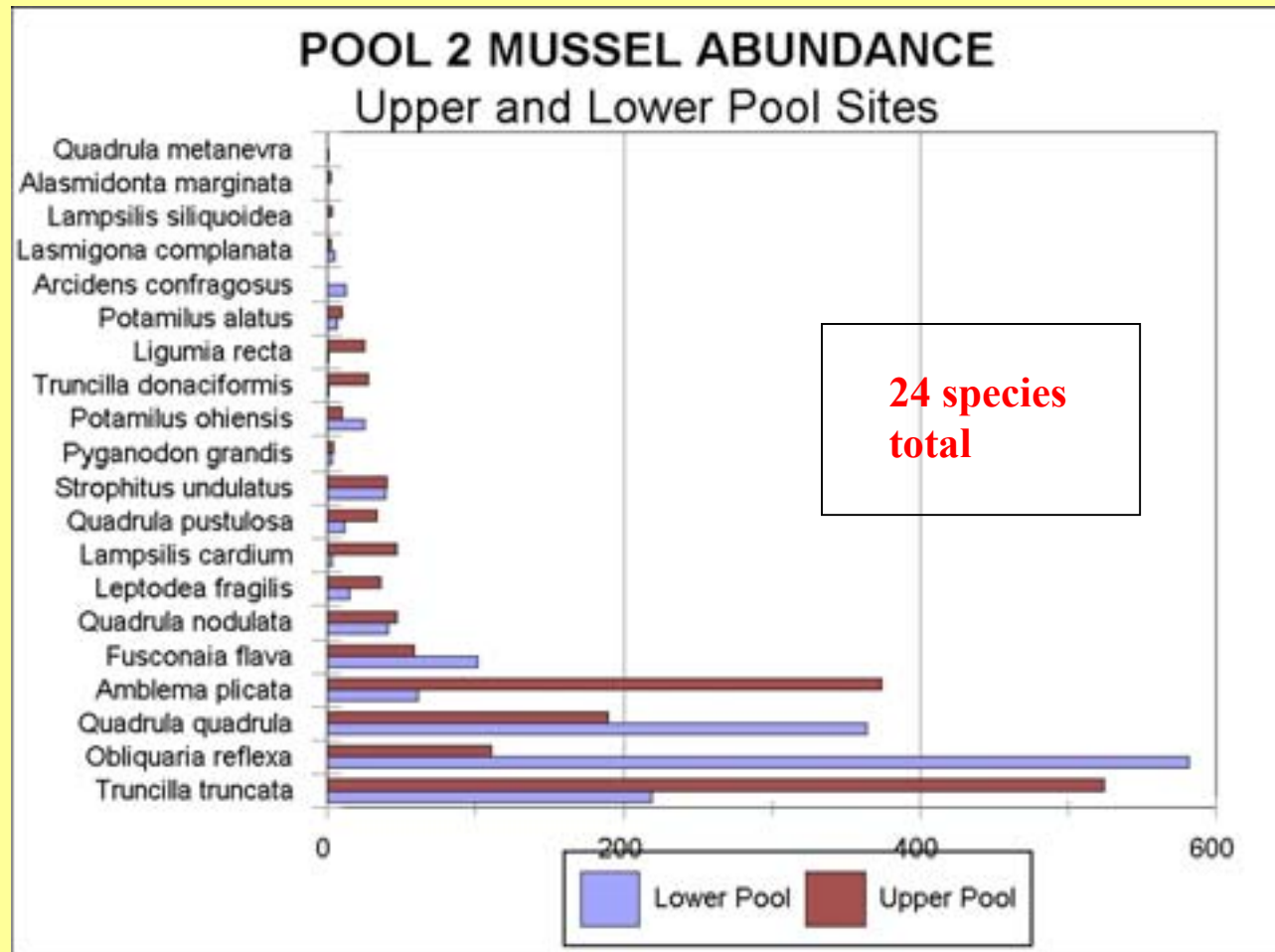


Population at this site is not recruiting frequently and is dominated by older individuals

Data from quadrat samples

A survey conducted in 1977-78 in Pools 1 and 2 found live mussels (9 species) only in the tail-waters of Lock and Dam 1. They reported that “There was no evidence of recent recruitment....”

In 2000 we found 24 species including two state endangered species and observed that many species were represented by individuals less than 10 years old.









POOL 2



POOL 3



**Pool 2 transplant site
(954 individuals of 8 species)**

**Pool 3 transplant site
(1,481 individuals of 7 species)**

Number of individuals	Species	MN/Fed Status	Number of individuals	Species	MN/Fed Status
370	<i>Lampsilis higginsii</i> Higgins' eye	Endangered (MN&Fed)	101	<i>Lampsilis higginsii</i> Higgins' eye	Endangered (MN&Fed)
55	<i>Arcidens confragosus</i> rock pocketbook	Endangered (MN)	37	<i>Arcidens confragosus</i> rock pocketbook	Endangered (MN)
180	<i>Megaloniais nervosa</i> washboard	Threatened (MN)	466	<i>Megaloniais nervosa</i> washboard	Threatened (MN)
152	<i>Elipsaria lineolata</i> butterfly	Threatened (MN)	424	<i>Elipsaria lineolata</i> butterfly	Threatened (MN)
19	<i>Quadrula metanevra</i> monkeyface	Threatened (MN)	21	<i>Quadrula metanevra</i> monkeyface	Threatened (MN)
31	<i>Pleuroberma coccinium</i> round pigtoe	Threatened (MN)	32	<i>Pleuroberma coccinium</i> round pigtoe	Threatened (MN)
8	<i>Elipio dilatata</i> spike	Special concern (MN)	0	<i>Elipio dilatata</i> spike	Special concern (MN)
139	<i>Ligumia recta</i> black sandshell	Special concern (MN)	400	<i>Ligumia recta</i> black sandshell	Special concern (MN)



Collect gravid females



Flush glochidia



Infect fish hosts



Inspect fish for infection level



**Cages built and placed in river
June 2001**



**Juvenile Higgins' Eyes
recovered from one cage
September 2001**



**Juvenile Higgins' Eyes
with byssal threads**





